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Dietary patterns among British adults: compatibility with dietary guidelines for salt/sodium, fat, saturated fat and sugars

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Abstract

Objective: To examine dietary patterns among British adults, associations with Na and macronutrient intakes, and implications for dietary advice.
Design: Principal component analysis of 7 d weighed dietary records.
Subjects: Adults aged 19–64 years (*n* 1724).
Setting: National Diet and Nutrition Survey (2000/2001).
Results: High Na intake was associated with more energy-dense diets, higher in fat and SFA (percentage of energy) but lower in non-milk extrinsic sugars (NMES). Eight patterns (PC1 to PC8) explained 40 % of the total variance in food intakes. Three patterns – PC3 (high loadings on bread, fats and cheese), PC2 (meat products, eggs and chips) and PC7 (red meat, sauces and alcohol) – were associated with high Na intake. Of these, PC3 correlated with high Na density and Na:K ratio, while PC2 correlated with fat. By contrast, three patterns – 'health-conscious' (PC1; vegetables, fruit, fruit juice, fish), 'breakfast cereals and milk' (PC6) and 'chicken and rice' (PC8) – were associated with modest Na intake, lower Na density and lower fat and SFA. PC2 was positively correlated, and PC1 was negatively correlated, with adding salt to food. Other patterns were 'tea/coffee and cakes' (PC4; associated with high SFA and NMES) and 'soft drinks and snacks' (PC5; associated with high NMES but not fat or SFA). The dietary patterns of males and females differed slightly.
Conclusions: Dietary patterns PC1, PC6, PC8 (vegetables, fruit, fish, milk, breakfast cereals, poultry) were broadly compatible with guidelines for salt, fat, SFA and NMES. However, other patterns tended to be high in either salt or NMES.

Keywords
Dietary pattern
Principal component
Sodium
Salt
Fat
Sugar
Adults

In 1994 the Committee on Medical Aspects of Food and Nutrition Policy reviewed nutritional influences on CVD including the impact of Na on blood pressure. It recommended a reduction in the population average intake of salt from approximately 9 g to 6 g daily for adults[1]. This was subsequently reiterated by the Scientific Advisory Committee on Nutrition (SACN) in 2003[2], which also set recommendations for salt intakes among children.

The rationale for lowering Na intake across the population is that this would lead to clinically significant reductions in blood pressure[3], which could have a substantial effect on cardiovascular events and health-care costs[4]. However, the evidence is not without contention and results from meta-analyses have been mixed[5–7]. Graudal *et al.* concluded in 1998 that studies did not support a general recommendation to reduce Na intake but did support use as a supplementary treatment in hypertension[8]. This and other earlier meta-analyses[9,10] have been criticised for including trials of short duration and trials of acute salt loading followed by severe depletion which does not reflect the 'real-life' situation. A more recent meta-analysis of eleven trials lasting more than 4 weeks among individuals with normal blood pressure reported that a 4·4 g reduction in mean salt intake was associated with a 2 mmHg reduction in systolic and a 1 mmHg reduction in diastolic blood pressure[4]. The effect for people with hypertension was greater (5 mmHg and 2.7 mmHg for systolic and diastolic blood pressure, respectively). Similar results were reported in a Cochrane review by Jurgens and Graudal, who concluded that longer-term trials of effects on metabolic variables, morbidity and mortality are required[7]. Results from the randomised Trials of Hypertension Prevention over 10–15 years have reported that a very-low-salt diet reduced cardiovascular events by 25–30 %[11] and it has been claimed that Na reduction may have benefit independent of its impact on hypertension[12,13].

Salt (NaCl) in the diet derives from three sources: (i) discretionary salt (added at the table or in cooking); (ii) salt naturally present in food and water; and

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(iii) salt added in food processing. These are estimated to account for approximately 15 %, 15 % and 70 %, respectively, of the total salt consumed[14]. The SACN report suggested that reduction in the average salt intake would be best achieved using a population-based approach through the adoption of a healthy balanced diet, low in salt and fat and rich in fruit, vegetables and complex carbohydrates. Since approximately 75 % of total salt was estimated to be derived from processed foods[15], significant reductions in the Na content of processed foods were needed, requiring the cooperation of industry[2]. Accordingly, in March 2006 the Food Standards Agency published the (voluntary) salt reduction targets for 2010 and in May 2009 issued revised salt reduction targets for 2012[16], which were even more challenging than the previous targets for 2010. The food industry has reformulated many products to reduce salt content. However current intakes among adults (based on Na excretion) are still estimated to be about 8·6 g/d[17], in excess of the population target of 6 g/d. For labelling purposes 1 g Na is equivalent to 2.5 g salt.

Ongoing monitoring of Na intake and Na levels in foods is required to assess progress towards the targets. The SACN report also identified the need to improve the existing evidence base, particularly on how patterns of Na vary across and within population groups and the contribution of home-prepared foods and meals out[2]. Dietary patterns give more insights into real-life conditions and may have a greater effect on health outcomes than amounts of individual foods or nutrients[18]. Principal component analysis (PCA) is an established multivariate technique to reduce food consumption data to a smaller number of underlying factors or dietary patterns[19,20]. These patterns are uncorrelated with each other and explain variations in food intake across a population. In the present study, PCA was used to identify dietary patterns in the National Diet and Nutrition Survey (NDNS) of adults. These patterns were related to indicators of dietary quality, including but not limited to salt intake, with the intention of helping to inform dietary strategies for improved public health nutrition. We hypothesised that a 'healthy eating' pattern (high in fruit/vegetables/fish) was likely to be low in salt and that a high relative consumption of bread, cheese and meat products was likely to be high in salt and might be associated with other CVD risk factors.

Methods

Data sets

Computerised files from the NDNS for adults aged 19 to 64 years were obtained from the UK Data Archive (www.data-archive.ac.uk). The NDNS surveyed a nationally representative sample of adults living in private households in Great Britain, selected using a multistage random probability design with postal sectors as first-stage units. Fieldwork covered a 12-month period in 2000/2001 to cover any seasonality in eating behaviour and in the nutrient content of foods. Overall, 61 % of the eligible sample (n 3704) completed the dietary interview (responding sample, n 2251) and 77 % of those who completed the dietary interview completed a full 7 d weighed dietary record (diary sample, n 1724, representing >12 000 person-days of data)[21]. Following the diary period, anthropometric and blood pressure measurements were taken from consenting respondents and a 24 h urine sample collected (n 1379).

Data analysis

The NDNS contains data on more than 7000 foods, aggregated into 115 food groups, which for the present study were further aggregated into thirty-four larger food groups. Foods that made a minor contribution to Na intake (e.g. fruits) or those that had similar Na content (e.g. breads) were combined to avoid large numbers of spurious comparisons. At the same time, separate categories for types of meat and meat products (sausages, burgers, pies) and other items such as baked beans, pasta, pizza and rice were retained. The NDNS data files include information on the Na content of each food item consumed, calculated from the nutrient databank linked to the survey. Quantities of the thirty-four food groups consumed and their contribution to Na intake were calculated on an absolute basis (g or mg per day) and also on an energy-adjusted basis (g or mg per MJ of total diet).

Statistical methods

All analyses were performed using the PASW Statistics 18 statistical software package (SPSS Inc., Chicago, IL, USA). Differences in food and nutrient intakes according to level of Na intake were assessed using the Kruskal–Wallis test (non-parametric ANOVA) and the pairwise comparison test with Bonferroni correction (shown in tables in the form $1 < 2 < 3$ denoting low < medium < high).

PCA uses the degree to which foods are correlated with each other to derive a new set of variables which are composites. These can be thought of as discrete patterns, as they are uncorrelated with each other. Individuals then have a score on each dietary pattern corresponding to the extent to which their unique food selection deviates from it. Food amounts are standardised so that those with larger variance do not have undue influence. PCA produces as many components as there are food variables but the first few explain proportionally more of the variance in the data. The convention is to choose those with eigenvalues above 1 and/or use a scree plot and/or assess the interpretability of different solutions[22].

Prior to conducting PCA, Barlett's test of sphericity and the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy (KMO = 0·67) was used to confirm that there were relationships between the food variables and that the analysis should yield distinct and reliable patterns[23].

Using the intake data on all thirty-four food groups (g/d) we first extracted all components with an eigenvalue >1 and then used the scree plot to select the number to retain. Since there were no clear grounds for preferring six, eight or twelve components, we explored all three solutions, using varimax rotation to maximise separation. The eight-component solution was chosen as offering the best compromise between parsimony and ability to explain a sufficient proportion of the variance (40 %). Components were then interpreted on the basis of their correlations with food groups (loadings). Foods with loadings >0·30 were considered as contributing significantly to a pattern. The robustness of the analysis was also checked by examining PCA conducted first for men and women separately and second on a random 50 % sample.

Individuals' scores on each factor were calculated by the Anderson–Rubin method, which produces scores that are uncorrelated and standardised (mean of zero and standard deviation of 1). Pearson's correlation coefficients were calculated between adults' factor scores and nutrient intakes to identify patterns associated with Na intake and dietary Na density. Age and sociodemographic profile of patterns were assessed by comparing mean factor scores across categories of age, social class, region, smoking habit and discretionary salt use, with adjustment for multiple comparisons (Bonferroni correction). All tests were considered significant at $P < 0·05$.

Results

The majority of low salt consumers (<6 g/d) were women (81 %) and the majority of high salt consumers (≥8 g/d) were men (79 %); this reflects the nature of the salt recommendations which are absolute, rather than proportional, to total food or energy intake. There was no significant difference in mean age or age distribution between low, medium and high salt consumers. A high proportion of each age group reported adding salt in cooking (62–72 %), but more low salt consumers reported never adding salt at the table (31 % *v.* 22 % high of consumers).

High salt consumers tended to eat more food overall, including low-salt foods such as milk and vegetables. Mean and median consumption of bread, spreads and bacon/ham were two to three times higher in those consuming ≥8 g salt/d than among low consumers (<6 g salt/d; Appendix 1).

On an energy-adjusted basis (g food/MJ diet), high salt consumers of both sexes ate proportionately more bread, biscuits and cakes, fats, bacon/ham and baked beans, while men who were high consumers also ate relatively more cheese, sausages, sauces and savoury snacks. Conversely, low salt consumers consumed more beverages and vegetables relative to their energy intake (Appendix 2).

Bread was the largest single contributor to total Na intake, providing about 22 % of Na for men and 21 % for women (Appendix 3). Other major sources were bacon and ham (9 % and 7 % for men and women, respectively) and other meat products such as sausages and pies, while chicken and turkey dishes also contributed more than 5 %. Sauces (gravy, ketchup, mayonnaise, etc.) contributed approximately 5 % of all Na, as did breakfast cereals, although this group includes porridge with salt. Excluding porridge, the contribution from other ready-to-eat breakfast cereals in 2000/2001 was 4·2 %.

Increased consumption of salt was associated with increased dietary energy density and Na density. High salt consumers (≥8 g/d) had diets with a higher percentage of energy from fat and SFA (Table 1). Conversely low salt consumers (<6 g/d) tended to have diets higher in non-milk extrinsic sugars (NMES; $P < 0·05$ among men only). Low salt consumers had recorded Na intakes that averaged only 61–67 % of Na excretion, compared with 86–91 % among high salt consumers.

Table 1 Mean energy and nutrient intakes according to level of salt intake: adults aged 19–64 years (*n* 1724), National Diet and Nutrition Survey (2000/2001)

	Men				Women			
	Salt intake			Multiple comparison test†	Salt intake			Multiple comparison test†
	<6 g/d	6–8 g/d	≥8 g/d		<6 g/d	6–8 g/d	≥8 g/d	
n	134	249	383		571	286	101	
Age of respondent (years)	43	43	41	NS	42	42	41	NS
Na intake (mg/d)	1893	2803	4069	1 < 2 < 3	1852	2713	3655	1 < 2 < 3
Dietary Na density (mg/MJ)	287	324	371	1 < 2 < 3	317	364	414	1 < 2 < 3
Dietary Na:K ratio	0·79	0·92	1·11	1 < 2 < 3	0·82	0·98	1·19	1 < 2 < 3
Energy intake (MJ/d)	6·92	8·96	11·14	1 < 2 < 3	6·06	7·66	9·07	1 < 2 < 3
Energy density (kJ/g)	2·97	3·28	3·43	1 < 2 < 3	2·84	3·06	3·35	1 < 2 < 3
% of energy from fat	31	34	34	1 < 3	33	34	35	1 < 2 < 3
% of energy from SFA	11	13	13	1 < 2,3	12	13	13	1 < 3
% of energy from NMES	15	12	12	1 < 2,3	12	11	11	1 < 3
Urinary Na (mg)	3117	3869	4746	1 < 2 < 3	2844	3098	4006	1 < 2 < 3

NMES, non-milk extrinsic sugars.
†Bonferroni correction.

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Principal component analysis of food patterns

In the total sample, eight patterns (components) accounted for 40% of the total variance in food intakes. They were interpreted as follows, based on the foods with which they were most highly correlated:

1. 'health-conscious' (high in vegetables, fruit, water and fish);
2. 'chips, meat products and eggs' (including sausages, meat pies and baked beans);
3. 'bread, fat spread and cheese';
4. 'coffee/tea and cakes' (hot beverages, sugar, confectionery, biscuits and cakes);
5. 'soft drinks and snacks' (soft drinks, pizza, pasta and savoury snacks);
6. 'breakfast cereal and milk';
7. 'red meat and alcohol' (including sauces);
8. 'chicken and rice'.

Table 2 gives the correlation coefficients (factor loadings) for the top eight patterns with the individual foods, where coefficients are greater than 0·30. Table 3 shows their correlations with energy and nutrient intakes, Na density and excretion, blood pressure, anthropometric measurements and reported use of salt at the table. All correlations were adjusted for age.

In line with the hypothesis, PC1 (health-conscious) was inversely correlated with the Na:K ratio of the diet. Conversely, PC2 (chips, meat products and eggs), PC7 (red meat and alcohol) and especially PC3 (bread, fat spread and cheese) were associated with high salt intake, while PC3 was also associated with higher Na density (mg/MJ diet) and Na:K ratio. Correlations with fat were highest for PC2 (positive) and PC6 (breakfast cereal and milk; negative). PC4 (coffee/tea and cakes) was most highly correlated with SFA and NMES, but inversely correlated with dietary Na density. PC5 (soft drinks and snacks) was associated with high NMES but not fat or SFA. There were weak trends with discretionary salt use; positive for PC2 and negative for PC1. Finally the three patterns associated with high Na intake (PC2, PC3, PC7) were weakly correlated with urinary Na, while PC7 was also correlated with waist circumference and (weakly) with blood pressure.

Figures 1 and 2 display the correlations with Na intake and dietary Na density for each of the dietary patterns (data from Table 3).

Additional PCA were run for men and women separately, using the same extraction criterion (eight factors). Similar but not identical patterns, including a 'health-conscious' pattern, a 'bread and spread' pattern, a 'hot drinks and sweets' pattern and a 'soft drinks and savoury snacks' pattern were observed in both (Tables 4 and 5). Among both men and women, the bread and spread pattern was most highly correlated with Na intake, Na density and Na:K ratio and also with SFA. The health-conscious pattern (and to a lesser extent the 'cereals and milk, chicken' pattern among men) was inversely correlated with fat, SFA, NMES and Na:K ratio. The pattern characterised by hot beverages, milk and sugar or cakes tended to be high in SFA and NMES but of low Na density.

Some individual food groups clustered differently. For example, breakfast cereals were associated with the health-conscious pattern among women, but were in a separate pattern among men. Similarly, bacon/ham, sausages, eggs and chips were clustered together for men, but this pattern was less apparent for women (bacon/ham being associated with bread). The groups featuring breakfast cereals tended to conform to dietary guidelines while those with meat products tended to be high in Na, fat and SFA.

Tables 6 and 7 show the correlations of the sex-specific dietary patterns with energy and nutrient intakes, Na density and excretion, blood pressure and anthropometric measurements (all correlations were adjusted for age).

Results on the random 50% sample with a six-component solution (data not shown) also yielded patterns that could be interpreted as 'health-conscious', 'bread/spread/bacon/ham', 'hot beverages, milk and sugar',' soft drinks/savoury snacks/pizza', 'meat pies, sausages, eggs and chips' and 'chicken and rice'.

Discussion

Analysis of dietary patterns takes account of the multi-dimensional nature of food habits as practised in the population. It therefore has the potential to provide a more realistic basis for dietary advice, complementing approaches based on the contribution of foods to the average diet. It may also highlight the compatibility or otherwise of multiple dietary guidelines. An increasing number of epidemiological studies are favouring PCA or factor analysis to explore patterns within the data set and relate these to other variables. Many find a 'healthy' or 'prudent' pattern contrasted with a 'traditional' or 'Western' pattern[22,24–27]. Studies in adolescents and children tend to find fewer patterns explaining more of the variance, suggesting a more limited variety of intakes among this age group than is observed among adults[26,28].

The results of the present study compare well with the analysis of the German Potsdam cohort of the European Investigation into Cancer and Nutrition, in which seven patterns (factors) explained 31% of the variance and a bread and sausage pattern was associated with high salt intake[29]. In a study of incident hypertension among women in the same cohort[30], there was an (inverse) association with a 'DASH-type'[18] diet (Dietary Approaches to Stop Hypertension; fruit, vegetables and milk products) but no significant association with either the 'traditional cooking' pattern or the 'fruits and vegetables' pattern after adjustment for potential confounders. Several studies investigating dietary patterns in both sexes have found slight differences between men and women but major patterns that were common to both[29–32].

Table 2 Correlation of dietary patterns obtained from principal component analysis with foods (correlations less than 0·30 not shown): all men and women (*n* 1724), National Diet and Nutrition Survey (2000/2001)

	PC1 Health-conscious	PC2 Chips, meat products and eggs	PC3 Bread, fat spread and cheese	PC4 Tea/coffee and cakes	PC5 Soft drinks and snacks	PC6 Breakfast cereal and milk	PC7 Red meat and alcohol	PC8 Chicken and rice
Vegetables	0·68							
Fruit	0·61							
Puddings, yoghurt & ice cream	0·49					0·35		
Fish	0·46				−0·32			
Water	0·40							
Fruit juice	0·38							0·35
Chips & fried potatoes		0·62						
Sausages		0·42					0·34	
Meat pies		0·41						
Eggs		0·36						
Baked beans		0·33						
Soup		−0·31						
Burgers & kebabs								
Bread			0·76					
Fat spreads			0·74					
Cheese			0·48					
Other cereal products			−0·34					
Sugar, preserves & confectionery				0·66				
Beverages (hot)				0·66	−0·31			
Biscuits, cakes & pastries				0·46				
Soft drinks		0·32			0·62			
Pizza					0·49			
Pasta		−0·38			0·44			
Savoury snacks					0·44			
Breakfast cereal						0·74		
Milk				0·41		0·66		
Red meat							0·55	
Alcoholic drinks							0·45	
Sauces	0·36				0·34		0·43	
Bacon/ham		0·34					0·38	
Other meat & offal							0·34	
Rice								0·74
Chicken & turkey						0·41		0·58
Other potatoes							0·31	−0·45
% of variance explained	6·4	5·6	5·3	5·1	4·8	4·7	4·5	4·3

Table 3 Correlations of dietary patterns obtained from principal component analysis with energy and nutrient intakes, food habits and health indices (adjusted for age): all men and women (n 1724), National Diet and Nutrition Survey (2000/2001)

	PC1 Health-conscious	PC2 Chips, meat products and eggs	PC3 Bread, fat spread and cheese	PC4 Tea/coffee and cakes	PC5 Soft drinks and snacks	PC6 Breakfast cereal and milk	PC7 Red meat and alcohol	PC8 Chicken and rice
Energy intake (kJ)	0·26	0·36	0·46	0·33	0·29	0·26	0·35	0·22
Energy density (kJ/g)	−0·04	0·40	0·20	0·11	0·12	−0·05	−0·14	0·13
% of energy from fat	−0·04	0·26	0·16	0·15	−0·02	−0·21	−0·03	−0·06
% of energy from SFA	−0·13	0·17	0·18	0·23	0·05	−0·11	−0·06	−0·18
% of energy from NMES	−0·15	0·12	−0·12	0·40	0·12	−0·02	−0·16	0·04
Na from food (mg)	0·20	0·32	0·60	0·15	0·25	0·20	0·38	0·10
Dietary Na density (mg/MJ)	−0·06	−0·03	0·26	−0·23	−0·03	−0·04	0·10	−0·15
Dietary Na:K ratio	−0·23	0·18	0·42	−0·05	0·15	−0·16	0·02	−0·01
Urinary Na (mmol/l)	0·06	0·19	0·22	0·00	0·10	0·03	0·24	0·08
Usually add salt to food	−0·16	0·15	0·02	0·07	−0·01	−0·10	0·10	−0·02
Usually add salt in cooking	−0·09	0·02	−0·02	−0·02	−0·04	−0·10	0·05	0·07
BMI (kg/m^2)	0·00	0·10	−0·02	−0·07	0·11	0·06	0·09	−0·01
Waist circumference (cm)	−0·04	0·19	0·13	−0·03	0·16	0·06	0·23	0·04
Systolic blood pressure (mmHg)	−0·08	0·10	0·09	−0·07	0·04	0·01	0·14	0·03
Diastolic blood pressure (mmHg)	−0·05	0·06	0·08	−0·02	0·02	−0·05	0·13	0·08

NMES, non-milk extrinsic sugars.
Coefficients (r) >0·10 were significant at $P<0·001$.

The results of the present study should be generalisable to the British adult free-living population. The NDNS sampling frame was designed to be nationally representative of adults in private households and those who completed the dietary record had a similar demographic profile by sex, age and social class to those interviewed. Furthermore, a separate investigation concluded that there was no serious evidence of non-response bias[21].

Inevitably, there are some limitations of the data and caveats are required. First, all estimates of total Na intake based on food records tend to underestimate true consumption because discretionary sources are not included and under-reporting of food intake is common. Comparison with urinary Na in the present study can only comprise partial validation because the single 24 h urine collection was made subsequent to the dietary records. However, other measurements of Na excretion indicate that underestimation in diet records is of the order of 25–30 %[17]. Therefore the present analysis overestimates the relative contribution of processed foods to Na intake in comparison to the discretionary sources. Second, estimates of the contribution from different food groups are limited by the inability to disaggregate composite dishes. For example, lasagne or shepherd's pie is classified as a meat dish, resulting in some overestimation of the Na contribution from meat and underestimation of the contribution from the sauce, vegetables, etc. Third, with regard to the dietary pattern analysis it is inevitable that use of different food groupings, extraction criteria and rotations can all influence results and that interpretation or naming of the components involves an element of subjectivity. Our separate analysis of men and women confirms other work suggesting that dietary patterns may be common to both but there are also subtle differences, which may deserve further study.

Significant reductions in Na content of foods have been achieved in manufactured foods since these data were collected in 2000 and this needs to be taken into account in interpreting the results in the current context. In particular, the Na content of branded breakfast cereals has declined by approximately 44 % since 2000 and reductions have also been made by industry for sliced bread (~ 30 %), cakes and biscuits (15–50 %), savoury snacks (up to 50 %), sauces and soups (25–30 %) and some processed cheeses[16]. In terms of the dietary patterns identified in the present study, this implies that the breakfast cereal and milk pattern would today be more strongly associated with lower Na intake, Na density and Na:K ratio, while the positive association of the bread, fat spread and cheese pattern might be slightly attenuated. Clearly, it would be desirable to conduct similar dietary pattern analyses on new data from the rolling NDNS programme once the sample size is sufficient.

Since dietary survey data do not capture all sources of Na, progress towards achievement of salt guidelines is best assessed from measures of urinary Na excretion. These confirm that mean salt intake among adults has declined

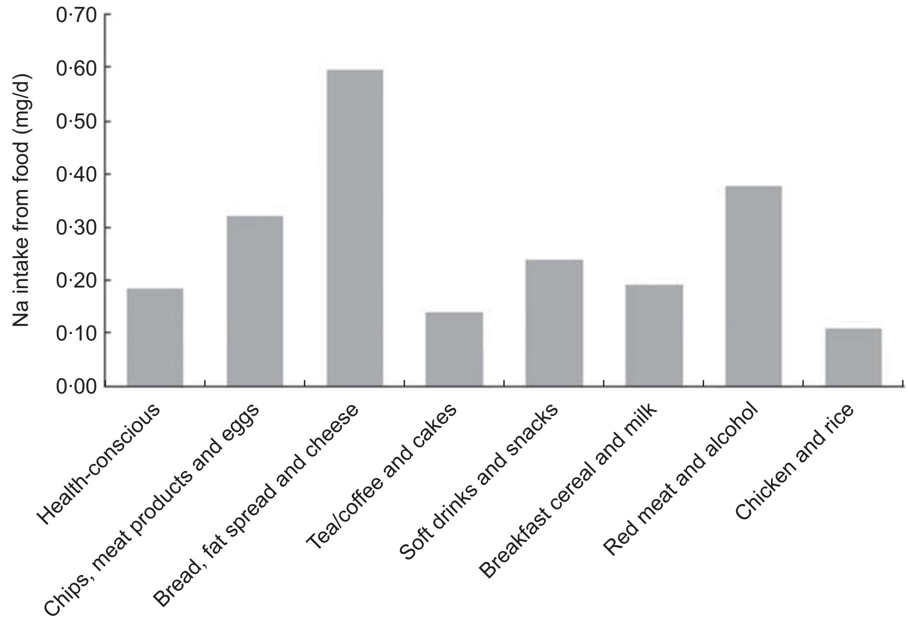

Fig. 1 Dietary patterns from principal component analysis and their correlation with sodium intake: adults aged 19–64 years (*n* 1724), National Diet and Nutrition Survey (2000/2001)

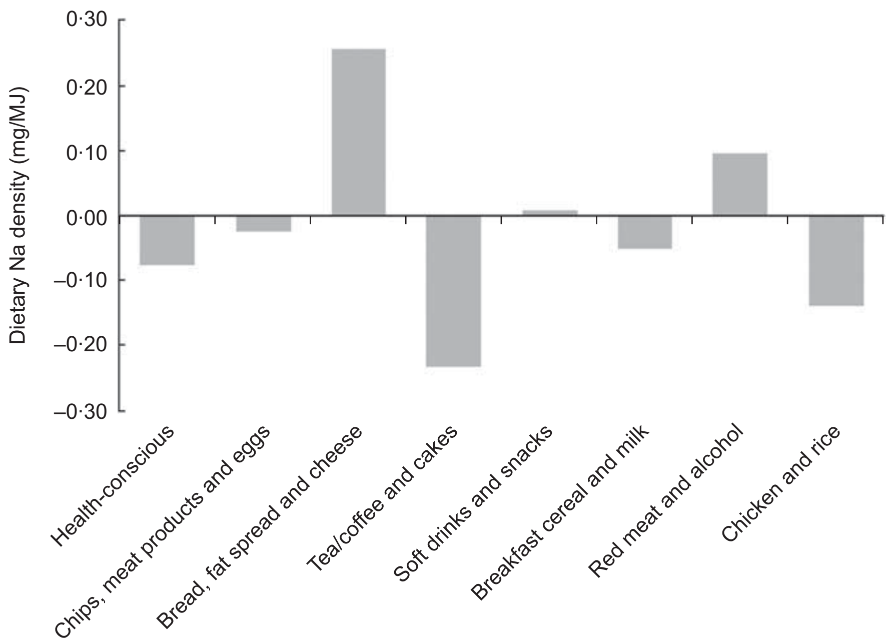

Fig. 2 Dietary patterns from principal component analysis and their correlation with dietary sodium density: adults aged 19–64 years (*n* 1724), National Diet and Nutrition Survey (2000/2001)

from 9·5 g/d to 8·6 g/d in 2008 (a 10 % reduction)[17]. Clearly there is some way to go to achieve 6 g/d (or less) as a population mean, while ambitions to apply this goal to individuals or to reduce it still further look unlikely to be achieved in the short term. However, if the reformulation successes of many cereal products and savoury snacks were replicated across the spectrum of processed foods, the 6 g/d goal could be achieved providing that consumers do not compensate by increasing their use of salt in cooking or at the table. Reductions in salt content of processed foods to date would seem to predict a steeper fall in Na excretion than has been observed in practice (10 %) and the reasons for this discrepancy are not entirely clear. There is to our knowledge no reliable data on discretionary salt consumption and there may be a need to better understand the impact of influences, such as celebrity chefs, meals out, home cooking *v.* ready meals and the popularity of spices and condiments, on this aspect of salt intake.

Table 4 Correlation of dietary patterns obtained from principal component analysis with foods (correlations less than 0·30 not shown): men only (*n* 766), National Diet and Nutrition Survey (2000/2001)

	PC1 Health-conscious (fruit, vegetables and fish)	PC2 Bread, spread and cheese	PC3 Cakes, sugar and beverages	PC4 Meat products, chips and eggs	PC5 Cereals and milk, chicken	PC6 Soft drinks, pizza and savoury snacks	PC7 Other meat and potatoes	PC8 Red meat and sauces
Fruit juice	0·58							
Vegetables	0·58							
Fish	0·53							
Fruit	0·52		0·34					
Water	0·37				0·30			
Meat pies	−0·32							
Bread		0·79						
Fat spreads		0·78						
Cheese		0·52						
Biscuits, cakes & pastries			0·60					
Alcoholic drinks			−0·54					
Puddings, yoghurt & ice cream	0·37		0·50					
Sugar, preserves & confectionery	−0·45							
Chips & fried potatoes				0·58				
Bacon/ham				0·48				
Sausages				0·47				
Eggs				0·46				
Pasta				−0·41				
Soup								
Breakfast cereal					0·78			
Milk & cream					0·65			
Chicken & turkey					0·60			
Soft drinks						0·71		
Pizza						0·57		
Beverages	−0·37		0·40			−0·40	0·30	
Savoury snacks						0·34		
Burgers & kebabs								
Rice							−0·60	0·37
Other potatoes							0·52	
Other meat & offal							0·46	
Baked beans								
Red meat								0·70
Sauces						0·31		0·39
Other cereal products								
% of variance explained	6·8	5·8	5·5	5·3	5·2	5·1	4·4	4·2

Table 5 Correlation of dietary patterns obtained from principal component analysis with foods (correlations less than 0·30 not shown): women only (*n* 958), National Diet and Nutrition Survey (2000/2001)

	PC1 Health-conscious (fruit, vegetables, sweet dairy and cereals)	PC2 Beverages, milk and sugar	PC3 Soft drinks and savoury snacks	PC4 Bread and spread	PC5 Rice and chicken	PC6 Meat products and chips	PC7 Sauces and alcohol	PC8 Red meat avoiders
Fruit	0·67							
Puddings, yoghurt & ice cream	0·64							
Vegetables	0·61						0·31	
Breakfast cereal	0·49							
Biscuits, cakes & pastries	0·37							
Water	0·33							
Beverages		0·73						
Milk & cream		0·69						
Sugar, preserves & confectionery		0·55						
Soft drinks			0·65					
Savoury snacks			0·55					
Fish			−0·41					
Soup			−0·35					
Burgers & kebabs			0·34					
Fat spreads				0·74				
Bread				0·69				
Fruit juice				0·34				
Eggs				0·32				
Rice					0·69			
Chicken & turkey					0·56			
Other potatoes					−0·44			
Cheese	0·33				−0·34			
Baked beans					−0·34			
Pasta						−0·58		
Meat pies						0·49		
Other meat & offal						0·43		
Chips & fried potatoes			0·36			0·38		
Sauces							0·67	
Alcoholic drinks							0·46	
Pizza							−0·37	
Sausages								
Other cereal products								0·57
Red meat								−0·50
Bacon/ham				0·30				−0·45
% of variance explained	7·0	5·4	5·3	5·1	4·4	4·4	4·0	4·0

Table 6 Correlations of dietary patterns obtained from principal component analysis with energy and nutrient intakes, food habits and health indices (adjusted for age): men only (*n* 766), National Diet and Nutrition Survey (2000/2001)

	PC1 Health-conscious (fruit, vegetables and fish)	PC2 Bread, spread and cheese	PC3 Cakes, sugar and beverages	PC4 Meat products, chips and eggs	PC5 Cereals and milk, chicken	PC6 Soft drinks, pizza and savoury snacks	PC7 Other meat and potatoes	PC8 Red meat and sauces
Energy intake (kJ)	0·00	0·49	0·30	0·27	0·32	0·21	0·08	0·25
Energy density (kJ/g)	−0·08	0·22	0·25	0·23	−0·10	0·11	−0·23	−0·21
% of energy from fat	−0·09	0·20	0·13	0·28	−0·18	0·05	−0·03	−0·05
% of energy from SFA	−0·27	0·21	0·22	0·10	−0·11	0·11	0·11	−0·09
% of energy from NMES	−0·33	−0·22	0·36	−0·07	−0·09	0·02	−0·02	−0·04
Na from food (mg)	0·07	0·67	0·11	0·28	0·19	0·22	0·10	0·23
Dietary Na density (mg/MJ)	0·08	0·33	−0·21	0·05	−0·10	0·04	0·05	0·04
Dietary Na:K ratio	−0·18	0·51	−0·11	0·08	−0·19	0·15	−0·14	−0·06
BMI (kg/m^2; *n* 723)	0·02	0·05	−0·07	0·14	0·02	0·13	0·03	0·09
Waist circumference (cm)	−0·01	0·10	−0·08	0·11	0·00	0·13	0·05	0·09
Systolic blood pressure (mmHg; *n* 717)	−0·07	−0·01	−0·16	0·02	0·02	0·00	0·04	0·02
Diastolic blood pressure (mmHg)	−0·05	−0·01	−0·11	0·02	−0·03	−0·03	0·03	0·02
Urinary Na (mg; *n* 623)	0·06	0·22	−0·02	0·19	0·04	0·08	0·02	0·14

NMES, non-milk extrinsic sugars.
Coefficients (*r*) >0·10 were significant at $P<0·01$ and those >0·20 were significant at $P<0·0001$.

Table 7 Correlations of dietary patterns obtained from principal component analysis with energy and nutrient intakes, food habits and health indices (adjusted for age): women only (*n* 958), National Diet and Nutrition Survey (2000/2001)

	PC1 Health-conscious (fruit, vegetables, sweet dairy and cereals)	PC2 Beverages, milk and sugar	PC3 Soft drinks and savoury snacks	PC4 Bread and spread	PC5 Rice and chicken	PC6 Meat products and chips	PC7 Sauces and alcohol	PC8 Red meat avoiders
Energy intake (kJ)	0·36	0·27	0·44	0·49	0·16	0·13	0·22	0·06
Energy density (kJ/g)	−0·12	−0·05	0·36	0·24	0·14	0·19	−0·23	−0·03
% of energy from fat	−0·18	0·05	0·11	0·32	0·02	0·33	0·00	0·08
% of energy from SFA	−0·16	0·15	0·15	0·29	−0·09	0·26	−0·07	0·08
% of energy from NMES	−0·11	0·30	0·26	−0·03	0·10	0·01	−0·11	0·16
Na from food (mg)	0·22	0·07	0·28	0·52	0·00	0·12	0·18	−0·06
Dietary Na density (mg/MJ)	−0·13	−0·20	−0·15	0·10	−0·20	−0·02	−0·05	−0·11
Dietary Na:K ratio	−0·34	−0·17	0·14	0·30	−0·02	0·14	−0·17	0·00
BMI (kg/m^2)	0·01	−0·09	0·13	−0·07	−0·04	0·03	0·01	−0·08
Waist circumference (cm)	−0·06	−0·11	0·11	−0·10	−0·09	0·06	0·03	−0·08
Systolic blood pressure (mmHg)	−0·12	−0·11	0·01	0·02	−0·02	0·03	0·04	−0·02
Diastolic blood pressure (mmHg)	−0·09	−0·07	0·00	0·04	0·05	−0·03	0·08	0·01
Urinary Na (mg)	0·03	−0·08	0·14	0·09	−0·02	0·08	0·06	−0·06

NMES, non-milk extrinsic sugars.
Coefficients (*r*) >0·10 were significant at $P<0·01$ and those >0·20 were significant at $P<0·0001$.

In the context of dietary guidelines for fat SFA and NMES, PC2 (chips, meat products and eggs) was correlated with high fat and high energy density, while a hot drinks/confectionery/cakes pattern (PC4 in combined analysis) was correlated with a diet high in SFA and NMES. Of the patterns correlated with high Na intake, only PC3 (bread, fat spread and cheese) was also correlated with high Na density and high Na:K ratio. By contrast three other patterns (health-conscious, breakfast cereals and milk, and chicken and rice) had other features, apart from low salt concentration, that are conducive to better health. PC1 is similar to the DASH diet[18] and consistent with dietary guidelines for SFA and NMES. It may also have an impact on energy density that could be beneficial in terms of obesity prevention. In the same way, the breakfast cereals and milk pattern was correlated with low Na:K ratio and relatively low Na density and NMES, while breakfast cereals also make important contributions to intakes of carbohydrate, NSP and micronutrients.

The SACN guidelines on salt continue to present a challenge given the current composition of the British diet, while the achievability of multiple guidelines is even more problematic. The present analysis would suggest that there may be more compatibility between salt, fat and SFA, than between salt and NMES. The dietary reference values for fat, SFA, NMES and salt were originally conceived as population targets rather than maxima for individuals and it may be unrealistic to expect individuals to attain them. The 10 % reduction in Na intakes since this NDNS was conducted in 2000/2001 is encouraging, but it is unclear to what extent this is inequitably distributed between health-conscious individuals and others, and how the balance in consumption between salt in processed foods and salt added in cooking or at the table may have shifted. Further research is required to examine how changes in food composition and choice have impacted nutrient intakes (including micronutrient intakes) for consumers with different food habits and lifestyles.

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References

1. Department of Health (1994) *Nutritional Aspects of Cardiovascular Disease. Report on Health and Social Subjects* no. 46. London: HMSO.
2. Scientific Advisory Committee on Nutrition (2003) *Salt and Health*. London: HMSO.
3. Sacks FM, Svetkey LP, Vollmer WM *et al.* (2001) Effects on blood pressure of reduced dietary sodium and the Dietary Approaches to Stop Hypertension (DASH) diet. DASH-Sodium Collaborative Research Group. *N Engl J Med* **344**, 3–10.
4. He FJ & MacGregor GA (2004) Effect of longer-term modest salt reduction on blood pressure. *Cochrane Database Syst Rev* issue 3, CD004937.
5. Hooper L, Bartlett C, Davey Smith G *et al.* (2002) Systematic review of long term effects of advice to reduce dietary salt in adults. *BMJ* **325**, 628.
6. He FJ & MacGregor GA (2002) Effect of modest salt reduction on blood pressure: a meta-analysis of randomized trials. Implications for public health. *J Hum Hypertens* **16**, 761–770.
7. Jurgens G & Graudal NA (2004) Effects of low sodium diet versus high sodium diet on blood pressure, renin, aldosterone, catecholamines, cholesterols, and triglyceride. *Cochrane Database Syst Rev* issue 1, CD004022.
8. Graudal NA, Galloe AM & Garred P (1998) Effects of sodium restriction on blood pressure, renin, aldosterone, catecholamines, cholesterols, and triglyceride: a meta-analysis. *JAMA* **279**, 1383–1391.
9. Midgley JP, Matthew AG, Greenwood CM *et al.* (1996) Effect of reduced dietary sodium on blood pressure: a meta-analysis of randomized controlled trials. *JAMA* **275**, 1590–1597.
10. Alam S & Johnson AG (1999) A meta-analysis of randomised controlled trials (RCT) among healthy normotensive and essential hypertensive elderly patients to determine the effect of high salt (NaCl) diet of blood pressure. *J Hum Hypertens* **13**, 367–374.
11. Cook NR, Cutler JA, Obarzanek E *et al.* (2007) Long term effects of dietary sodium reduction on cardiovascular disease outcomes: observational follow-up of the trials of hypertension prevention (TOHP). *BMJ* **334**, 885–888.
12. Perry IJ & Beevers DG (1992) Salt intake and stroke: a possible direct effect. *J Hum Hypertens* **6**, 23–25.
13. He FJ & MacGregor GA (2009) A comprehensive review on salt and health and current experience of worldwide salt reduction programmes. *J Hum Hypertens* **23**, 363–384.
14. British Nutrition Foundation (2004) *Salt in the Diet*. London: BNF.
15. Henderson L, Irving K, Gregory J *et al.* (2003) *The National Diet and Nutrition Survey: Adults Aged 19 to 64 years*. vol. 3: *Vitamin and Mineral Intake and Urinary Analytes*. London: TSO/Office for National Statistics.
16. Food Standards Agency (2009) Salt reduction targets, 2009. http://www.food.gov.uk/news/newsarchive/2009/may/salttargets (accessed May 2009).
17. Food Standards Agency (2008) Dietary sodium levels surveys, 2008. http://www.food.gov.uk/science/dietarysurveys/urinary (accessed July 2008).
18. Appel LJ, Moore TJ, Obarzanek E *et al.* (1997) A clinical trial of the effects of dietary patterns on blood pressure. DASH Collaborative Research Group. *N Engl J Med* **336**, 1117–1124.
19. Sharma S (1996) *Applied Multivariate Techniques*. New York: John Wiley & Sons, Inc.
20. Afifi AA, Clark VA & May S (2004) Principal components analysis. In *Computer-aided Multivariate Analysis*, 4th ed. pp. 369–390 [C Chatfield, M Tanner and J Zidek, editors]. Boca Raton, FL: Chapman & Hall/CRC.

21. Hoare J, Henderson L, Bates C *et al.* (2004) *The National Diet and Nutrition Survey: Adults Aged 19 to 64 years.* vol. 5: *Summary Report.* London: TSO/Office for National Statistics.
22. Hu FB, Rimm EB, Stampfer MJ *et al.* (2000) Prospective study of major dietary patterns and risk of coronary heart disease in men. *Am J Clin Nutr* **72**, 912–921.
23. Field A (2000) Exploratory factor analysis. In *Discovering Statistics using SPSS for Windows*, pp. 423–470 [DB Wright, editor]. London: SAGE Publications.
24. Osler M, Heitmann BL, Gerdes LU *et al.* (2001) Dietary patterns and mortality in Danish men and women: a prospective observational study. *Br J Nutr* **85**, 219–225.
25. Heidemann C, Schulze MB, Franco OH *et al.* (2008) Dietary patterns and risk of mortality from cardiovascular disease, cancer, and all causes in a prospective cohort of women. *Circulation* **118**, 230–237.
26. Ambrosini GL, Oddy WH, Robinson M *et al.* (2009) Adolescent dietary patterns are associated with lifestyle and family psychosocial factors. *Public Health Nutr* **12**, 1807–1815.
27. Pryer JA, Nichols R, Elliott P *et al.* (2001) Dietary patterns among a national random sample of British adults. *J Epidemiol Community Health* **55**, 29–37.
28. Aranceta J, Perez-Rodrigo C, Ribas L *et al.* (2003) Socio-demographic and lifestyle determinants of food patterns in Spanish children and adolescents: the enKid study. *Eur J Clin Nutr* **57**, Suppl. 1, S40–S44.
29. Schulze MB, Hoffmann K, Kroke A *et al.* (2001) Dietary patterns and their association with food and nutrient intake in the European Prospective Investigation into Cancer and Nutrition (EPIC) Potsdam study. *Br J Nutr* **85**, 363–373.
30. Schulze MB, Hoffmann K, Kroke A *et al.* (2003) Risk of hypertension among women in the EPIC–Potsdam study: comparison of relative risk estimates for exploratory and hypothesis-oriented dietary patterns. *Am J Epidemiol* **158**, 365–373.
31. Togo P, Heitmann BL, Sorensen TI *et al.* (2003) Consistency of food intake factors by different dietary assessment methods and population groups. *Br J Nutr* **90**, 667–678.
32. Lau C, Glumer C, Toft U *et al.* (2008) Identification and reproducibility of dietary patterns in a Danish cohort: the Inter99 study. *Br J Nutr* **99**, 1089–1098.

Appendix 1

Food consumption (mean, g/d) according to salt intake group: adults aged 19–64 years (n 1724), National Diet and Nutrition Survey (2000/2001)

	Men				Women			
	Salt intake group				Salt intake group			
Food (g/d)	1 (<6 g/d)	2 (6–8 g/d)	3 (≥8 g/d)	Multiple comparison test	1 (<6 g/d)	2 (6–8 g/d)	3 (≥8 g/d)	Multiple comparison test
n	134	249	383		571	286	101	
Pasta	21	23	36	1,2 < 3	22	28	24	1 < 2
Rice	32	31	32		20	24	33	1 < 3
Pizza	8	12	18	1,2 < 3	6	10	11	1 < 2
Other cereal products	4	5	5		4	5	5	
Bread	68	101	152	1 < 2 < 3	66	94	121	1 < 2 < 3
Breakfast cereal	16	31	40	1 < 3	22	32	38	1 < 2,3
Biscuits, cakes & pastries	22	35	47	1 < 2 < 3	23	37	46	1 < 2 < 3
Puddings, yoghurt & ice cream	24	44	47	1 < 2 < 3	39	51	50	1 < 2
Milk & cream	172	212	269	1,2 < 3	188	225	230	1 < 2,3
Cheese	9	15	22	1 < 2 < 3	12	16	18	1 < 2,3
Eggs	15	22	24		13	20	18	1 < 2
Fat spreads	8	12	19	1 < 2 < 3	8	11	16	1 < 2 < 3
Bacon/ham	9	15	25	1 < 2 < 3	8	14	18	1 < 2 < 3
Red meat	56	55	66		40	44	50	
Chicken & turkey	49	61	66	1 < 3	43	47	52	
Burgers & kebabs	10	11	11		5	5	7	
Sausages	6	11	17	1 < 2 < 3	5	6	11	1,2 < 3
Meat pies	11	18	23		7	13	15	1 < 2,3
Other meat & offal	7	8	14		5	5	10	1,2 < 3
Fish	24	37	32	1 < 2	28	33	34	
Vegetables excl. baked beans	109	115	124		111	135	131	1 < 2
Baked beans	10	15	27	1,2 < 3	9	14	23	1 < 2 < 3
Chips & fried potatoes	47	53	58		36	40	45	
Other potatoes	49	58	67	1 < 3	51	59	61	
Savoury snacks	4	7	10	1,2 < 3	5	7	10	1 < 2 < 3
Fruit	61	95	105	1 < 2,3	101	115	99	
Sugar, preserves & confectionery	32	29	33		21	24	29	1 < 3
Fruit juice	48	60	49		42	53	57	
Soft drinks	148	173	257	1,2 < 3	165	212	254	1 < 2,3
Beverages	702	741	820	1 < 3	685	743	742	
Soup	20	22	30		21	28	47	1,2 < 3
Sauces	17	24	34	1 < 2 < 3	19	27	30	1 < 2,3
Alcoholic drinks	465	459	540		137	138	174	
Water	190	243	261		300	321	303	

Appendix 2

Energy-adjusted food consumption (g/MJ) according to salt intake group: adults aged 19–64 years (n 1724), National Diet and Nutrition Survey (2000/2001)

	Men				Women			
	Salt intake group				Salt intake group			
Energy-adjusted food (g/MJ)	1 (<6 g/d)	2 (6–8 g/d)	3 (≥8 g/d)	Multiple comparison test	1 (<6 g/d)	2 (6–8 g/d)	3 (≥8 g/d)	Multiple comparison test
n	134	249	383		571	286	101	
Pasta	3·2	2·6	3·4		3·7	3·7	2·7	
Rice	4·3	3·6	2·9	1 > 3	3·4	3·1	3·7	
Pizza	1·2	1·3	1·7		1·1	1·4	1·2	
Other cereal products	0·6	0·5	0·5		0·7	0·6	0·5	
Bread	10·3	11·7	13·9	3 > 2,1	11·3	12·5	13·5	3,2 > 1
Breakfast cereal	2·4	3·3	3·6		3·5	4·2	4·4	
Biscuits, cakes & pastries	3·0	3·8	4·1	3 > 1	3·6	4·6	4·9	3,2 > 1
Puddings, yoghurt & ice cream	3·6	4·8	4·2		6·2	6·5	5·5	
Milk & cream	25·5	23·7	23·8		31·3	29·1	26·0	
Cheese	1·4	1·7	1·9	3 > 1	2·0	2·1	2·0	
Eggs	2·2	2·5	2·1		2·3	2·7	1·9	
Fat spreads	1·2	1·4	1·7	3 > 2,1	1·4	1·5	1·7	3 > 1
Bacon/ham	1·4	1·9	2·3	3 > 2,1	1·4	1·9	2·0	3,2 > 1
Red meat	7·9	6·3	5·9	1 > 2,3	6·8	5·9	5·7	
Chicken & turkey	7·4	6·9	6·0		7·3	6·2	5·7	
Burgers & kebabs	1·5	1·2	1·0		0·9	0·6	0·8	
Sausages	0·9	1·3	1·6	3 > 1	0·9	0·9	1·2	
Meat pies	1·6	2·1	2·1		1·2	1·7	1·6	
Other meat & offal	1·0	0·9	1·2		0·9	0·6	1·1	
Fish	3·7	4·3	3·0	2 > 3	4·7	4·5	3·9	
Vegetables excl. baked beans	16·1	13·2	11·4	1 > 2,3	18·6	17·7	14·6	1 > 3
Baked beans	1·5	1·8	2·5	3 > 1	1·7	2·0	2·5	3 > 1
Chips & fried potatoes	7·1	6·0	5·2	1 > 3	6·0	5·2	4·9	
Other potatoes	7·2	6·8	6·2		8·8	7·8	6·9	1 > 3
Savoury snacks	0·6	0·7	0·9	3 > 1	0·8	0·9	1·0	
Fruit	9·4	10·4	9·5		16·7	15·1	11·0	1 > 3
Sugar, preserves & confectionery	4·5	3·2	2·9	1 > 2,3	3·4	3·0	2·9	
Fruit juice	7·0	6·6	4·4	1,2 > 3	6·6	6·7	6·2	
Soft drinks	21·4	18·8	23·2		27·6	28·3	27·4	
Beverages	107·6	85·3	74·8	1 > 2,3	121·1	97·5	83·4	1 > 2,3
Soup	5·0	2·7	3·0		4·0	3·9	5·8	
Sauces	2·4	2·8	3·1	3 > 1	3·2	3·6	3·2	
Alcoholic drinks	62·1	49·3	47·7		22·1	17·6	19·2	
Water	28·8	27·5	23·9		53·5	42·4	34·6	

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Appendix 3

Percentage sodium contribution from food groups according to salt intake group (foods ranked in descending order of sodium contribution): adults aged 19–64 years (n 1724), National Diet and Nutrition Survey (2000/2001)

	Men				Women			
	Salt intake group				Salt intake group			
Percentage Na contribution from:	1 (<6 g/d)	2 (6–8 g/d)	3 (≥8 g/d)	Total	1 (<6 g/d)	2 (6–8 g/d)	3 (≥8 g/d)	Total
Bread	20·6	21·3	22·3	21·8	20·8	20·8	20·1	20·7
Bacon/ham	6·7	8·5	9·2	8·8	6·1	7·4	7·4	6·7
Chicken & turkey	6·4	5·2	4·7	5·0	5·8	4·9	4·3	5·2
Sauces	4·3	4·9	5·0	4·9	5·1	5·6	5·0	5·3
Breakfast cereal	3·6	4·4	4·8	4·6	5·1	5·8	6·1	5·5
Red meat	5·9	4·0	3·6	3·9	3·8	3·4	3·7	3·7
Cheese	3·6	3·8	3·9	3·8	4·1	3·9	3·4	3·9
Sausages	3·1	3·5	4·1	3·8	2·6	2·4	2·8	2·6
Biscuits, cakes & pastries	3·5	4·0	3·7	3·8	3·9	4·2	4·1	4·0
Fish	3·8	4·2	3·1	3·5	4·9	4·5	4·2	4·6
Baked beans	2·8	2·9	3·7	3·4	2·8	2·8	3·4	2·9
Fat spreads	2·9	3·0	3·5	3·3	3·1	3·1	3·3	3·1
Milk & cream	4·2	3·3	2·9	3·1	4·4	3·6	2·8	3·8
Vegetables excl. baked beans	3·6	2·7	2·8	2·8	4·1	4·0	4·7	4·2
Meat pies	2·8	3·0	2·7	2·8	1·7	2·2	2·0	1·9
Soup	2·6	2·9	2·7	2·7	3·9	4·1	5·8	4·3
Savoury snacks	1·7	2·1	2·4	2·2	2·4	2·5	2·5	2·4
Pizza	2·3	2·1	2·2	2·2	1·8	2·0	1·6	1·8
Other meat & offal	1·5	1·5	2·2	1·9	1·3	1·1	1·6	1·3
Eggs	1·7	2·1	1·8	1·9	1·9	2·2	1·5	2·0
Burgers & kebabs	2·8	1·7	1·4	1·6	1·3	1·0	1·1	1·2
Alcoholic drinks	1·8	1·3	1·1	1·2	0·5	0·4	0·4	0·4
Pasta	1·1	0·9	1·2	1·1	1·1	1·3	1·0	1·2
Puddings, yoghurt & ice cream	0·9	1·2	0·9	1·0	1·5	1·5	1·0	1·4
Rice	0·6	1·0	0·9	0·9	0·9	1·1	1·6	1·0
Other cereal products	0·8	0·9	0·6	0·7	0·8	0·8	0·7	0·8
Chips & fried potatoes	0·8	0·7	0·5	0·6	0·8	0·6	0·6	0·7
Other potatoes	0·5	0·5	0·6	0·5	0·8	0·6	0·5	0·7
Sugar, preserves & confectionery	0·5	0·6	0·5	0·5	0·6	0·6	0·5	0·6
Fruit	0·5	0·6	0·3	0·5	0·6	0·5	0·7	0·6
Soft drinks	0·5	0·4	0·4	0·4	0·5	0·5	0·4	0·5
Beverages	0·6	0·5	0·3	0·4	0·5	0·5	1·0	0·6
Fruit juice	0·2	0·2	0·2	0·2	0·2	0·2	0·2	0·2
Water	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0

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